

# Advanced Approaches to Greatly Reduce Hydrogen Gas Crossover Losses in PEM Electrolyzers Operating at High Pressures and Low Current Densities, Phase I

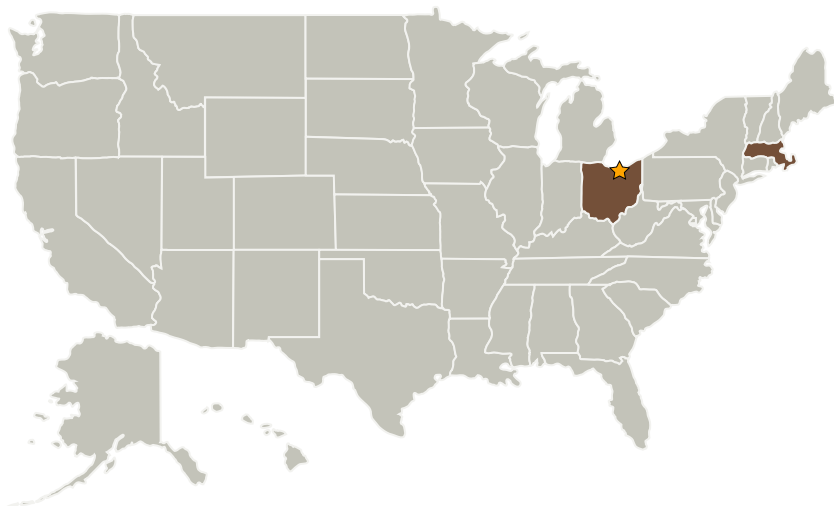
Completed Technology Project (2008 - 2008)



## Project Introduction

ElectroChem proposes technology advances in its unique PEM IFF water electrolyzer design to meet the NASA requirement for an electrolyzer that will operate very efficiently both at low current densities and at high pressures. This SBIR effort will develop technical solutions to the draw-back of high pressure operation, namely hydrogen gas crossover losses, that is, an increased diffusion of hydrogen across the membrane which effectively decreases the efficiency. Two approaches to reducing gas permeation through the membrane at high pressure will be investigated: 1) The use of palladium thin films embedded in the membrane; and 2) The use of Nafion proton conductive polymer-clay nanocomposite blends. Two different bonding approaches and membrane configurations will be used for the first approach. Determining the best composition is the key for the second approach. Promising candidates will be determined by two tests: 1) hydrogen permeability tests; and 2) proton conduction measurements to assure that the effects of reducing hydrogen permeability will not affect electrochemical proton conduction. Finally, the most promising candidates will undergo their final Ph I proof of concept tests in a PEM IFF electrochemical cell. Phase I will lead to the Ph II development of a complete PEM IFF Electrolyzer System and delivery of a demonstration unit to NASA.

## Primary U.S. Work Locations and Key Partners



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| Organizations Performing Work | Role                    | Type   | Location              |
|-------------------------------|-------------------------|--|-----------------------|
| ★ Glenn Research Center (GRC) | Lead Organization       | NASA Center  | Cleveland, Ohio       |
| ElectroChem, Inc.             | Supporting Organization | Industry<br>Minority-Owned Business, Women-Owned Small Business (WOSB) | Woburn, Massachusetts |

## Primary U.S. Work Locations

|               |      |
|---------------|------|
| Massachusetts | Ohio |
|---------------|------|

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Glenn Research Center (GRC)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Principal Investigator:

Michael Pien

## Technology Areas

### Primary:

- TX14 Thermal Management Systems
  - └ TX14.1 Cryogenic Systems
    - └ TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors